

**SANITARY SEWER ANALYSIS NARRATIVE**

**FIRST & MAIN  
BLACKSBURG, VIRGINIA**

**May 4, 2007**

This Narrative is to be used in conjunction with the Plans entitled  
"First & Main – Phase I Blacksburg" and "First & Main – Phase II Blacksburg"  
dated May 4, 2007, by Anderson & Associates, Inc.

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## A. DESIGN SUMMARY

Sanitary sewage from the First and Main development will discharge to the gravity sanitary sewer system in the Cedar Run sewershed and ultimately flow to the Cedar Run Pump Station. Inflow and infiltration (I/I) has been a significant problem within this basin and has caused the pump station to receive storm flows which exceed the 3.1 MGD design capacity of the station. Under dry weather conditions, flows to the station are typically 0.8 MGD. The Town has estimated that typical I/I for the basin (under dry weather conditions) is approximately 650 gpd per in-dia-mile of gravity pipe. This increases to approximately 6000 gpd/in-dia-mile for a 1 year storm and over 10,000 gpd/in-dia-mile during a 10 year storm.

The Town of Blacksburg is aware of the I/I problem in the basin and has been working to improve the situation. In addition to trying to reduce the I/I, the Town is also planning to provide additional equalization volume at the station. They are considering expanding the station capacity if the additional storage volume can not accommodate the storm flows.

Engineers from Anderson & Associates, Inc. and the Town of Blacksburg met to discuss the First and Main project and assess the ability of the existing sanitary sewer system to accept wastewater generated at the site. In order to help reduce I/I in the basin and improve ease of maintenance, the Town has requested that the design of the development comply with the following:

- No fill shall be placed over any existing sanitary sewer lines.
- New sanitary sewer lines shall not be installed greater than 15' below grade and shall be kept as shallow as possible (while maintaining minimum cover).
- To the extent practical, existing sewer lines through the development site shall be replaced.
- Layout of sanitary sewer system on the site shall be efficient and minimize the length of gravity lines, in order to minimize potential for I/I.
- Flow projections shall be computed according to DEQ SCAT Regulations and separately according to typical rates which the Town has provided.
- Calculations shall be provided to show that the gravity sewer lines downstream of the development will have available capacity to accept flow from the development under normal operating conditions (peak dry weather conditions).

As noted, the Town has recognized that capacity concerns at the Cedar Run Pump Station are mostly attributed to high I/I from the existing gravity sewer lines and is currently working to alleviate the problems. In light of this, the Town has indicated that they will accept the flow from the First and Main development if the previously outlined requests are met. This project will reduce existing I/I by replacing approximately 2400 linear feet of existing I/I susceptible terra-cotta pipe with new PVC pipe with gasketed joints. The project will also replace multiple existing I/I susceptible brick manholes with new pre-cast watertight concrete manholes.

## B. PROJECTED WASTEWATER FLOWS

Domestic wastewater projections for the First and Main project have been computed using both the conservative design rates outlined in the DEQ regulations as well as more realistic projections for actual demands. The Town of Blacksburg provided rates for various types of development, which reflect metered water usage for sampled locations throughout the Town.

Detailed flow projections for the prospective businesses within the development are shown on the following sheet. Total projected flows are summarized below:

Estimated per DEQ SCAT Regulations		Projected Actual Usage	
Average Daily Flow	162,702 gpd	Average Daily Flow	21,894 gpd
Peak Flow (2.5x)	406,755 gpd	Peak Flow (2.5x)	54,735 gpd
=	282 gpm	=	38 gpm

As requested by the Town, the majority of the existing sanitary sewer lines throughout the site will be replaced. In computing Inflow and Infiltration for the new lines, a rate of 500 gpd per in-dia-mile has been used (per direction from the Town). Total I/I for the new lines is computed as follows:

### New Gravity Sanitary Sewer in Development

Pipe Diameter	Total Length	Inch-Dia-Mile	Estimated I/I
10" Pipe	1800'	3.41	1704 gpd
8" Pipe	2065'	3.13	1564 gpd
Total =			3268 gpd

The most conservative estimation of wastewater flows is 165,970 gpd average daily flow. This is using the estimated flows per DEQ regulations and adding the I/I from the new sanitary sewer pipes. Flows will likely be significantly less, since the Town's studies have shown that actual water usage rates at similar businesses in Town are considerably lower. Additionally, portions of the site were previously developed which will offset some of these new flows. Existing I/I should also be reduced since approximately 2400 linear feet of existing terra-cotta pipe and brick manholes will be replaced with new gasketed PVC pipe and precast concrete manholes.

## C. DOWNSTREAM GRAVITY SEWER EVALUATION

The downstream gravity sewer system has been evaluated using data from a previously prepared computer model of the system. The model was originally prepared by Anderson & Associates in 1996 and has been updated multiple times since the initial creation. The model results for the existing system shows a peak dry weather flow of 1.827 MGD to the Cedar Run Pump Station. Assuming a 2.5 peaking factor, this would equate to an average daily flow of approximately 0.73 MGD. The actual peak flow factor is likely less than this, since a significant portion of the basins flow consists of background infiltration. The model data provides a relatively good correlation to the actual 0.8 MGD average daily flows which are observed at the pump station.

Wastewater from the First and Main development will discharge to existing manhole B06040 (using the Town's manhole designation). The following sheet shows estimated

existing peak sanitary flows from manhole B06040 downstream to the Cedar Run Pump Station. The minimum available peak flow capacity through any of the downstream pipes is approximately 677,000 gpd. This occurs in the pipe exiting manhole B05014, approximately 400 feet downstream of the proposed connection from the new development.

The conservative flow projections for the First and Main development show average daily flows not to exceed 166,000 gpd and peak flows not to exceed 406,000 gpd; therefore, it is concluded that all downstream lines will continue to have available pipe capacity during normal peak dry weather flow conditions.





# **APPENDIX A**

## **Projected Wastewater Flows**



**First and Main Project  
Projected Wastewater Flows**

4/3/2007

Est. per DEQ SCAT Regulations						Projected Actual Usage <sup>1</sup>				
Unit #	Unit Tenant	Unit Use	Unit Size (SF)	# of Seats (Restaurant )	Unit	Daily Flow per unit (gpd)	Estimated Flow (gpd)	Town Classification	Avg. Water Usage (gpd/sf)	Flow Projection (gpd)
1	Cinema Superfun USA	Cinema	36,487		sqf	0.25	9,122	UCM	0.0107	390
	Superfun USA	Restaurant	4,000	160	sqf	50.00	8,000	Restaurant	0.1510	604
2	Beamers	Entertainment	32,487		sqf	0.25	8,122	UCM	0.0107	348
3	Elderberry's	Restaurant	5,600	224	seat	50.00	11,200	Restaurant	0.1510	846
4	Available	Restaurant	1,500	60	seat	50.00	3,000	Restaurant	0.1510	227
5	Hallmark	Retail	1,200		sqf	0.25	300	Retail	0.0330	40
6	Maggie Moo's	Retail	4,000		sqf	0.25	1,000	Retail	0.0330	132
7	Blue Ridge Mt. Sports	Restaurant	1,200	48	seat	50.00	2,400	Restaurant	0.1510	181
8		Retail	6,000		sqf	0.25	1,500	Retail	0.0330	198
9	Brewery	Restaurant	10,000	400	seat	50.00	20,000	Restaurant	0.1510	1,510
10	Gold's Gym	Gym	32,000		sqf	0.40	12,800	N/A*	N/A*	5,040*
11	Available	Retail	8,668		sqf	0.25	2,167	Retail	0.0330	286
12	Great Clips	Salon	1,200		sqf	1.00	1,200	UCM	0.0107	13
13	Replay	Retail	2,100		sqf	0.25	525	Retail	0.0330	69
14	Baja Bistro	Restaurant	2,523	101	seat	50.00	5,046	Restaurant	0.1510	381
15	Books-a-Million	Retail	15,584		sqf	0.25	3,896	Retail	0.0330	514
16	Hibbetts Sports	Retail	4,800		sqf	0.25	1,200	Retail	0.0330	158
17	Rack Room Shoes	Retail	5,007		sqf	0.25	1,252	Retail	0.0330	165
18	Ann Taylor Loft	Retail	5,703		sqf	0.25	1,426	Retail	0.0330	188
19	Joseph A. Bank	Retail	4,000		sqf	0.25	1,000	Retail	0.0330	132
20	Jewell's	Retail	1,600		sqf	0.25	400	Retail	0.0330	53
21	Dandelion Feet	Retail	1,200		sqf	0.25	300	Retail	0.0330	40
22	Talbot's	Retail	4,000		sqf	0.25	1,000	Retail	0.0330	132
23	Cold Water Creek	Retail	6,000		sqf	0.25	1,500	Retail	0.0330	198
24	Salon & Spa	Salon	3,400		sqf	1.00	3,400	UCM	0.0107	36
25	Available	Retail	1,600		sqf	0.25	400	Retail	0.0330	53
26	Available	Retail	4,928		sqf	0.25	1,232	Retail	0.0330	163
27	Enzo's	Restaurant	3,000	110	seat	50.00	5,500	Restaurant	0.1510	453
28	Available	Retail	9,888		sqf	0.25	2,472	Retail	0.0330	326
29	Outparcel	Restaurant	3,965	159	seat	50.00	7,930	Restaurant	0.1510	599
30	Outparcel	Restaurant	3,984	159	seat	50.00	7,968	Restaurant	0.1510	602
31	Outparcel	Restaurant	4,919	197	seat	50.00	9,850	Restaurant	0.1510	743
32	Outparcel	Restaurant	5,485	219	seat	50.00	10,970	Restaurant	0.1510	828
33A	Pharmacy	Retail	12,900		sqf	0.25	3,225	Retail	0.0330	426
33B	Big Box Retail	Retail (Domestic)	176,411		sqf	0.25	5,200	Retail	0.0330	5,822
	Big Box Retail	Retail (Irrigation)	176,411			0.25	6,200	Retail	N/A	N/A
Average Daily Flow						162,702 gpd		Average Daily Flow		21,894 gpd
Peak Flow (2.5x)						406,755 gpd		Peak Flow (2.5x)		54,736 gpd
						=				=
						282 gpm				38 gpm

**Notes:**

- Where possible, "Actual Projected Usages" are calculated using typical flow rates provided by the Town of Blacksburg. The Town has developed typical usage rates for various types of developments, based on actual water meter records.
- Town's flow rate classifications do not include a rate appropriate for Gold's Gym. Although University City Mall contains a similar facility, the rate (per square footage) is computed for the entire mall and does not reflect direct usage at the gym. The usage for the Gold's Gym is computed assuming 4 showers operating continuously for 14 hours, at 1.5 gpm per shower.



## **APPENDIX B**

### **Existing Downstream Sewer Analysis**



**First and Main Project  
Existing Downstream Sewer Analysis**

4/3/2007

Upstream MH	Downstream MH	Invert Up (ft.)	Invert Down (ft.)	Slope	Length (ft.)	Section Size (in.)	System I/I (gpd)	Domestic Peak Flow (gpd)	Total Flow (gpd)	Design Capacity (gpd)	Available Capacity (gpd)
B06040	B05013	2,081.47	2,073.02	2.10%	402	10	115,685	59,889	175,574	2,052,954	1,877,380
B05013	B05014	2,073.02	2,066.74	52.30%	12	10	115,785	59,889	175,674	10,243,610	10,067,936
B05014	B05016	2,066.74	2,066.22	0.40%	143	10	116,983	59,889	176,872	853,881	677,009
B05016	B05018	2,066.02	2,064.78	0.50%	249	10	145,567	86,023	231,590	999,252	767,662
B05018	B05044	2,064.44	2,059.86	1.10%	403	10	279,188	303,981	583,169	1,509,538	926,369
B05044	B05913	2,059.76	2,055.54	1.10%	368	10	282,271	303,981	586,252	1,516,338	930,086
B05913	B05047	2,055.34	2,054.20	1.10%	102	10	283,126	303,981	587,107	1,496,981	909,874
B05047	B05048	2,053.90	2,051.92	1.60%	127	10	409,567	397,856	807,423	1,768,050	960,627
B05048	B05049	2,051.86	2,045.44	1.60%	413	10	413,027	397,856	810,883	1,765,454	954,571
B05049	B05914	2,045.34	2,043.40	1.70%	115	10	413,991	397,856	811,847	1,839,144	1,027,297
B05914	B05051	2,043.30	2,039.50	2.00%	187	10	415,558	397,856	813,414	2,018,528	1,205,114
B05051	B05052	2,039.40	2,033.48	2.60%	231	10	417,493	397,856	815,349	2,266,829	1,451,480
B05052	B05053	2,033.28	2,026.60	3.20%	207	10	419,228	411,140	830,368	2,543,706	1,713,338
B05053	B05054	2,026.50	2,018.16	2.70%	313	10	421,850	411,140	832,990	2,311,398	1,478,408
B05054	B05055	2,018.11	2,012.64	2.60%	208	10	423,593	411,140	834,733	2,296,285	1,461,552
B05055	B05056	2,012.54	2,006.46	2.60%	232	10	425,537	411,140	836,677	2,292,301	1,455,624
B05056	B05060	2,006.31	1,999.33	2.60%	270	10	445,895	413,803	859,698	2,276,720	1,417,022
B05060	B05061	1,998.93	1,989.96	3.00%	302	12	448,931	413,803	862,734	5,158,815	4,296,081
B05061	B05102	1,989.96	1,989.02	5.50%	17	12	478,831	413,803	892,634	7,038,768	6,146,134
B05102	B05062	1,988.97	1,985.18	2.00%	190	10	480,423	413,803	894,226	1,999,892	1,105,666
B05062	B05063	1,985.03	1,983.30	0.80%	217	12	482,605	413,803	896,408	2,672,701	1,776,293
B05063	B05064	1,983.28	1,982.04	0.70%	169	12	484,304	413,803	898,107	2,564,039	1,665,932
B05064	B04911	1,981.94	1,979.69	2.20%	100	12	485,310	413,803	899,113	4,490,022	3,590,909
B04911	Wetwell	1,978.24	1,974.00	5.40%	79	12	635,727	1,191,398	1,827,125	6,934,682	5,107,557